

WHAT IS CLAIMED IS:

1. An apparatus for pumping flowable material, comprising:
 - a first barrel;
 - a first piston movable within the first barrel, thereby
 - 5 dividing the first barrel into a first head-side chamber and a first rod-side chamber;
 - a second barrel;
 - a second piston movable within the second barrel, thereby
 - dividing the second barrel into a second head-side chamber and a
 - 10 second rod-side chamber;
 - a pump for delivering fluid to the first and second barrels;
 - a valve movable between a first position wherein the pump communicates with the first rod-side chamber, and a second
 - position wherein the outlet of the pump communicates with the
 - 15 first head-side chamber.
2. The apparatus of claim 1, wherein the valve comprises passages therein such that the first head-side chamber communicates with the second head-side chamber in the first
- 20 position, and the first rod-side chamber communicates with the second rod-side chamber in the second position.

3. The apparatus of claim 1, further comprising ports in the first and second barrels communicating with the first head-side chamber, second head-side chamber, first rod-side chamber, and second rod-side chamber, respectively, and wherein the valve
5 comprises one or more transfer passages that connect the port communicating with the first head-side chamber to the port communicating with the second head-side chamber in the first position, and connect the port communicating with the first rod-side chamber to the port communicating with the second rod-side
10 chamber in the second position.

4. The apparatus of claim 1, wherein the valve is configured such that the pump communicates with the second rod-side chamber in the first position, and the pump communicates
15 with the second head-side chamber in the second position.

5. The apparatus of claim 4, wherein the pump comprises an outlet for delivering fluid to the first and second barrels, the pump configured for alternately connecting the outlet to the
20 first and second rod-side chambers when the valve is in the first position, and connecting the outlet to the first and second head-side chambers when the valve is in the second position.

6. The apparatus of claim 5, wherein the pump comprises an inlet for removing fluid from the first and second barrels, the pump configured for alternately connecting the inlet to the first and second rod-side chambers when the valve is in the first position, and connecting the inlet to the first and second head-side chambers when the valve is in the second position.

7. The apparatus of claim 1, further comprising:

one or more sensors for measuring a parameter related to at least one of the fluid delivered by the pump and the first and second barrels; and

a controller coupled to the valve and the one or more sensors, the controller moving the valve between the first and second positions based upon the parameter measured by the one or more sensors.

8. The apparatus of claim 7, wherein the one or more sensors comprise one or more sensors for measuring pressure of at least one of the fluid delivered by the pump and within the cylinders.

9. The apparatus of claim 8, wherein the controller is configured for moving the valve to the first position when the

pressure rises above a first predetermined threshold, and to the second position when the pressure falls below a second predetermined threshold.

5 10. The apparatus of claim 9, wherein the second predetermined threshold substantially equals the first predetermined threshold.

10 11. An apparatus for pumping concrete or other flowable material, comprising:

 a first barrel;

 a first piston dividing the first barrel into a first head-side chamber and a first rod-side chamber, the first piston being movable within the first barrel for increasing and decreasing a
15 volume of the first head-side and rod-side chambers;

 a second barrel;

 a second piston dividing the second barrel into a second head-side chamber and a second rod-side chamber, the second piston being movable within the second barrel for increasing and
20 decreasing a volume of the second head-side and rod-side chambers;

a pump comprising an outlet for delivering fluid to the first and second barrels, and a inlet for removing fluid from the first and second barrels; and

a valve movable between first and second positions, wherein,
5 in the first position, the outlet of the pump communicates with at least one of the first and second rod-side chambers and a transfer line connects the first head-side chamber with the second head-side chamber, and, in the second position, the outlet of the pump communicates with at least one of the first and
10 second head-side chambers and a transfer line connects the first rod-side chamber with the second rod-side chamber.

12. The apparatus of claim 11, further comprising a first rod coupled to the first piston and extending through the first
15 rod-side chamber, the first rod being movable as the first piston reciprocates within the first barrel, and a second rod coupled to the second piston and extending through the second rod-side chamber, the second rod being movable as the second piston reciprocates within the second barrel.

20

13. The apparatus of claim 12, further comprising pump cylinders coupled to the first and second rods, the pump

cylinders being movable by the first and second rods for pumping concrete or other flowable material using the pump cylinders.

14. The apparatus of claim 11, further comprising:

5 one or more sensors for measuring pressure of at least one of the fluid delivered by the pump and the first and second barrels; and

a controller coupled to the valve and the one or more sensors, the controller moving the valve between the first and
10 second positions based upon pressure measured by the one or more sensors.

15. The apparatus of claim 14, wherein the controller is configured for moving the valve to the first position when the
15 pressure rises above a first predetermined threshold, and to the second position when the pressure falls below a second predetermined threshold.

16. A method for pumping flowable material using a pumping
20 apparatus comprising first and second drive cylinders, the method comprising:

delivering fluid into the cylinders to reciprocate pistons within the cylinders;

monitoring pressure within the pumping apparatus; and
switching a direction of flow of the fluid between at least
first and second configurations, wherein the first configuration
comprises delivering fluid into a rod side of the cylinders when
5 the pressure within at least one of the cylinders is below a
predetermined pressure threshold, and the second configuration
comprises delivering fluid into a head side of the cylinders when
the pressure within at least one of the cylinders exceeds the
predetermined pressure threshold.

10

17. The method of claim 16, wherein fluid is transferred
between the head sides of the cylinders in the first
configuration, and wherein fluid is transferred between the rod
sides of the cylinders in the first configuration.

15

18. The method of claim 16, wherein the fluid is delivered
alternately between the first and second cylinders such that the
piston within the first cylinder is advanced when the piston
within the second cylinder is retracted, and the piston within
20 the first cylinder is retracted when the piston within the second
cylinder is advanced.

PATENT

19. The method of claim 16, wherein rods are connected to the pistons, and wherein the rods provide power to pump the flowable material.

5 20. The method of claim 16, wherein the flowable material comprises concrete.